REMARKS

The Office Action dated October 14, 2005, has been received and reviewed.

Claims 1-28 are currently pending and under consideration in the above-referenced application, each standing rejected.

Reconsideration of the above-referenced application is respectfully requested.

Rejections Under 35 U.S.C. § 103(a)

Claims 1-28 stand rejected under 35 U.S.C. § 103(a).

The standard for establishing and maintaining a rejection under 35 U.S.C. § 103(a) is set forth in M.P.E.P. § 706.02(j), which provides:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Chen in View of Danek

Claims 1, 8-10, 12-14, 18-20, 23, and 25-28 are rejected under 35 U.S.C. § 103(a) for reciting subject matter which is assertedly unpatentable over the subject matter taught in U.S. Patent 6,020,259 to Chen et al. (hereinafter "Chen"), in view of teachings from U.S. Patent 6,699,530 to Danek et al. (hereinafter "Danek").

Chen teaches a process that include selectively depositing titanium silicide on a surface of a silicon substrate that is exposed through a contact opening, then blanket depositing titanium nitride over the interconnect. Chen does not include any teaching or suggestion that these deposition processes may be effected *in situ*.

The teachings of Danek are directed to processes in which a diffusion barrier is formed by depositing a material, annealing the material, and oxidizing or stuffing silicon atoms into the

material *in situ*. While Danek teaches that deposition and annealing processes may be repeated to form a multi-layer diffusion barrier, Danek does not teach or suggest that a metal silicide may be formed and an interconnect material deposited *in situ*, with the interconnect material being deposited after then metal silicide is formed.

It is respectfully submitted that there are at least two reasons that the teachings of Chen and Danek do not support a *prima facie* case of obviousness against any of claims 1, 8-10, 12-14, 18-20, 23, or 25-28.

First, it is respectfully submitted that, without the benefit of hindsight that the disclosure and claims of the above-referenced application afford to the Examiner, one of ordinary skill in the art would not have been motivated to combine teachings from Chen and Danek in the manner that has been asserted. It has been asserted that, since Chen teaches a process in which a metal silicide and an interconnect material may be deposited and that both of these materials may be deposited by the same process (*i.e.*, chemical vapor deposition (CVD)), that it would have been obvious to one of ordinary skill in the art to effect these deposition process *in situ* with one another. If it would have been obvious to conduct deposition processes that require at least one different reactant *in situ* with one another, then there surely would have been some disclosure to that effect in the prior art. Unfortunately, there is none. Instead, the Examiner has relied upon the teachings of Danek, which are limited to effecting a single deposition process, a subsequent anneal step, and a subsequent oxidation *in situ*.

Notably, the teachings of Chen and Danek are limited to introducing single sets of reactants into a chamber while a semiconductor substrate resides therein. More specifically, in Chen, a first set of reactants, which are necessary for depositing titanium silicide, are introduced into a chamber with a substrate therein, then the semiconductor substrate is removed from the chamber. The semiconductor substrate is then introduced into another reaction chamber where titanium nitride is deposited as another, second set of reactants chemically react with each other. One of ordinary skill in the art would readily understand that separate chambers were required to prevent contamination of the titanium nitride deposition process by residual reactants from the titanium silicide deposition process.

In Danek, one set of reactants is introduced into a chamber to effect a deposition process. The different gases used to anneal the titanium nitride layer of Danek are not reactants. As the teachings of Danek are limited to use of a single set of reactants to deposit a layer, the residual reactants that are present during subsequent processing in the same chamber will not contaminate the deposited layer.

Therefore, neither Chen nor Danek includes any teachings or suggestions that could have motivated one of ordinary skill in the art to combine their teachings in such a way as to effect to different deposition processes *in situ* with one another.

Second, Chen and Danek, taken either together or separately, do not teach or suggest each and every element of any of claims 1, 8-10, 12-14, 18-20, 23, or 25-28.

Neither Chen nor Danek teaches or suggests "depositing an interconnect material onto . . . metal silicide after and in situ with causing [a] chemical reaction" "to selectively deposit metal silicide" on the "surface of at least one exposed, doped area of [a] semiconductor device structure," as required by independent claim 1. Moreover, Chen and Danek both lack any teaching or suggestion of "depositing an interconnect material onto [a] contact material after and in situ with causing [a] chemical reaction" "to selectively deposit [the] contact material" on an "exposed active device region of [a] semiconductor device structure," as required by independent claim 20.

In this regard, Chen merely teaches that "a blanket chemical vapor deposition is carried out . . . to form a TiN layer" subsequent to the selective deposition of a $TiSi_2$ layer. Col. 3, lines 20-23. The teachings of Danek are limited to forming one or more layers from a single diffusion material (*i.e.*, a binary metal nitride or a ternary metal silicon nitride (*see, e.g.*, col. 4, lines 8-12)), annealing, and oxidizing the diffusion material or exposing it to silane, all *in situ*. Like Chen, Danek does not teach or suggest "depositing an interconnect material . . . after and in situ with" selective deposition of a metal silicide or any other contact material, as would be required for the purported combination of Chen and Danek to teach or suggest each and every element of independent claims 1 and 20.

Therefore, it is respectfully submitted that, under 35 U.S.C. § 103(a), independent claims 1 and 20 recite subject matter which is allowable over the teachings of Chen and Danek, taken either collectively or separately.

Claims 8-10, 12-14, 18, and 19 are each allowable, among other reasons, for depending directly or indirectly from claim 1, which is allowable.

Each of claims 23 and 25-28 is allowable, among other reasons, for depending directly or indirectly from claim 20, which is allowable.

Chen, Danek, and Chang

Claims 2-5, 21, and 22 have been rejected under 35 U.S.C. § 103(a) for being directed to subject matter which is allegedly unpatentable over teachings from Chen, in view of the subject matter taught in Danek and, further, in view of the teachings of U.S. Patent 5,043,299 to Chang et al. (hereinafter "Chang").

Claims 2-5 are each allowable, among other reasons, for depending directly or indirectly from claim 1, which is allowable.

Claims 21 and 22 are both allowable, among other reasons, for depending directly and indirectly, respectively, from claim 20, which is allowable.

Claim 22 is further allowable since none of Chen, Danek, or Chang, taken collectively or individually, teaches or suggests exposing a semiconductor device structure to a nitrogen-ammonia plasma. While the Office has asserted, at page 5 of the Final Office Action, that use of a nitrogen-ammonia plasma would be obvious depending upon the type of material to be cleaned, the Office has not shown any art that discloses use of such a plasma. The Office's requirement that some unexpected result of the use of such a plasma be shown is misplaced, as the patent laws do not require a showing of unexpected results; rather, a showing of unexpected results is merely one of the ways in which a *prima facie* case of obviousness, which has not been set forth in this case, may be rebutted. M.P.E.P. § 2144.05 III.

Chen, Danek, and Kolar

Claims 6 and 7 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is purportedly unpatentable over the teachings of Chen, in view of teachings from Danek and, further, in view of the subject matter taught in U.S. Patent 5,162,259 to Kolar et al.

Claims 6 and 7 are both allowable, among other reasons, for depending directly and indirectly, respectively, from claim 1, which is allowable.

Chen, Danek, and Kim

Claims 11 and 24 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is assertedly unpatentable over that taught in Chen et al., in view of the teachings of Danek and, further, in view of teachings from U.S. Patent 5,821,164 to Kim et al. (hereinafter "Kim").

Claim 11 is allowable, among other reasons, for depending directly from claim 1, which is allowable.

Claim 24 is allowable, among other reasons, for depending directly from claim 20, which is allowable.

Furthermore, a *prima facie* case of obviousness has not been established against either claim 11 or claim 24. Kim has been relied upon for purportedly teaching that an interconnect material may be selectively deposited. Kim even asserts that a conductive layer 16, which may be formed from a material such as aluminum, copper, titanium, or titanium nitride, may be "selectively deposited on the exposed surface of [an] interlevel layer 14a[,] including [a] contact hole 15[therethrough]." Col. 4, lines 24-27. From FIG. 2f of Kim, however, it appears that the interlevel layer 14a covers the entire substrate 11, and that the entire upper surface of interlevel layer 14 appears to be exposed. Thus, deposition of the conductive layer 16 would certainly not be selective. Moreover, the formation of conductive layer 16 must be followed by an etch-back, as explained at col. 4, lines 28-31 of Kim, to remove conductive material from the upper surface of the interlevel layer 14a and, thus, to define conductive lines 16 within the contact holes 15.

Chen and Danek also lack any teaching or suggestion of selectively depositing an interconnect material.

As claims 11 and 24 both require that an interconnect material be selectively deposited, according to the ordinary meaning of that term, as used in the art, the teachings of Kim cannot be combined with teachings from Chen and Danek to establish a *prima facie* case of obviousness against either of these claims.

Chen, Danek, and Shinriki

Claims 15-17 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is allegedly unpatentable over the subject matter taught in Chen, in view of teachings from Danek and, further, in view of the teachings of U.S. Patent 6,001,729 to Shinriki et al.

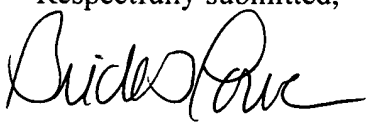
Claims 15-17 are each allowable, among other reasons, for depending directly or indirectly from claim 1, which is allowable.

It is respectfully requested that the 35 U.S.C. § 103(a) rejections of claims 1-28 be withdrawn.

CONCLUSION

It is respectfully submitted that each of claims 1-28 is allowable. An early notice of the allowability of each of these claims is respectfully solicited, as is an indication that the above-referenced application has been passed for issuance. If any issues preventing allowance of the above-referenced application remain which might be resolved by way of a telephone conference, the Office is kindly invited to contact the undersigned attorney.

Respectfully submitted,



Brick G. Power
Registration No. 38,581
Attorney for Applicants
TRASKBRITT, PC
P.O. Box 2550
Salt Lake City, Utah 84110-2550
Telephone: 801-532-1922

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